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(58) Field of Search

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(54) Abstract Title

Call screening based on subscriber location in a cellular communication system

(57) A communication system 10 includes a receiver for receiving a call for routing to a communication unit 12-16 operable within the communication system 10. The receiver is operably coupled to a processor and call determination means. The call determination means determines at least one parameter associated with the call and said processor employs a rule based call-delivery function to determine whether to route said call to said communication unit 12-16, based on said determined parameter. A communication unit and method for routing a call in the communication system are provided.

Significantly improved customer satisfaction is obtained with the service by virtue of the fact that the user can control what calls are received at various times. The subscriber no longer needs to interact personally with the system to screen calls at the point of ringing; many or most unwanted calls are barred before ringing occurs.

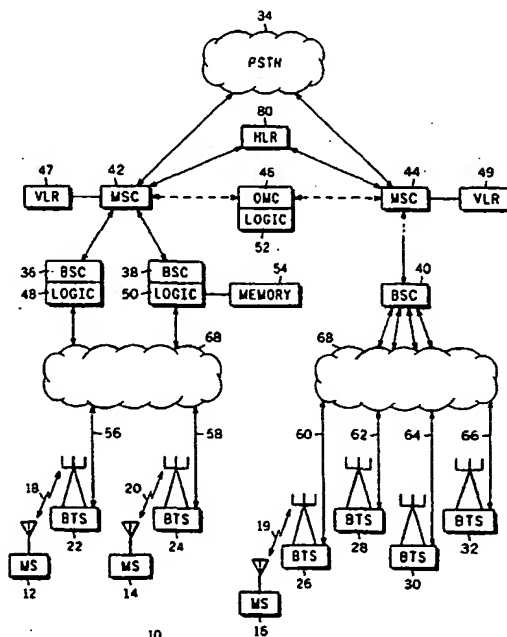
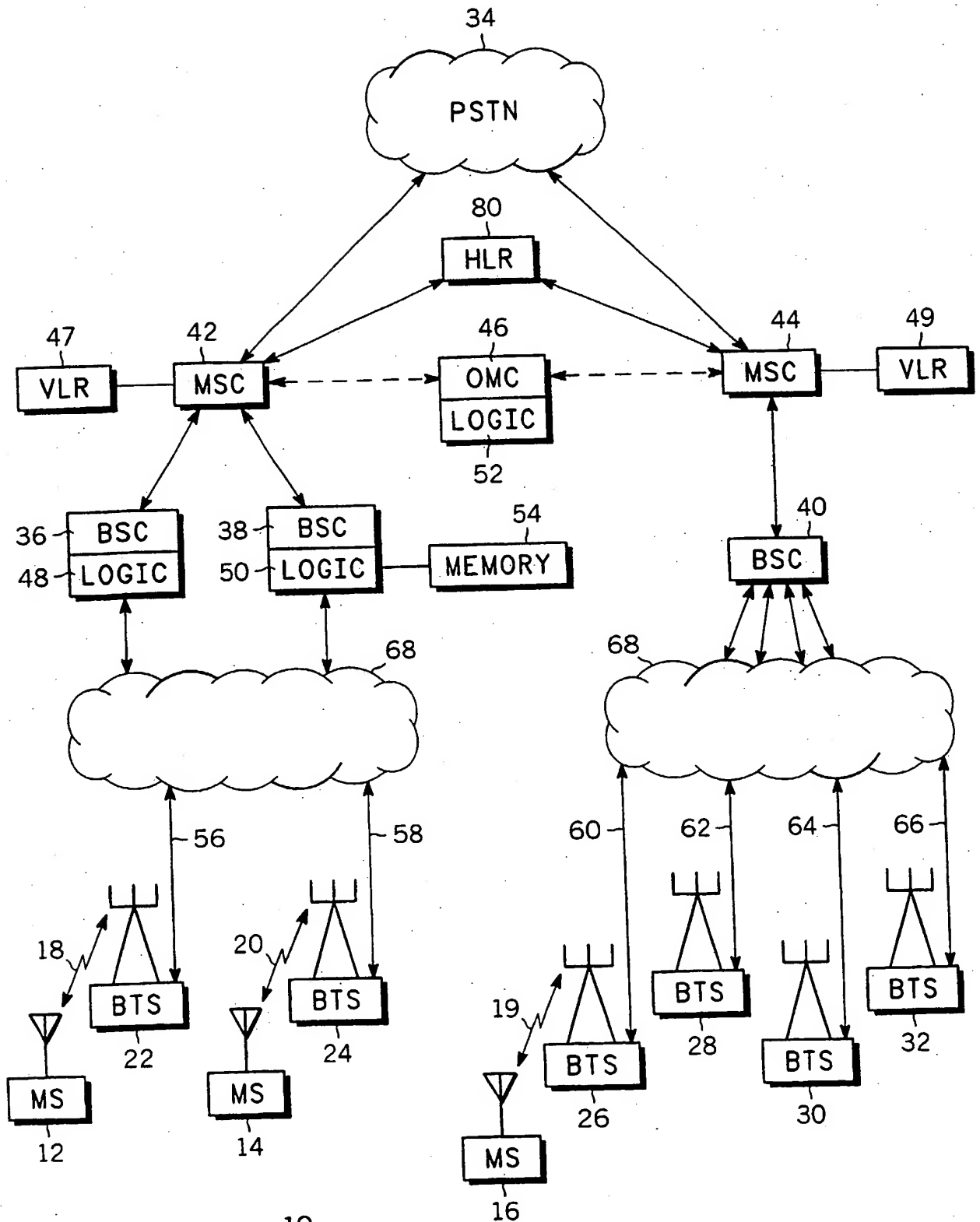


FIG. 1



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FIG. 1

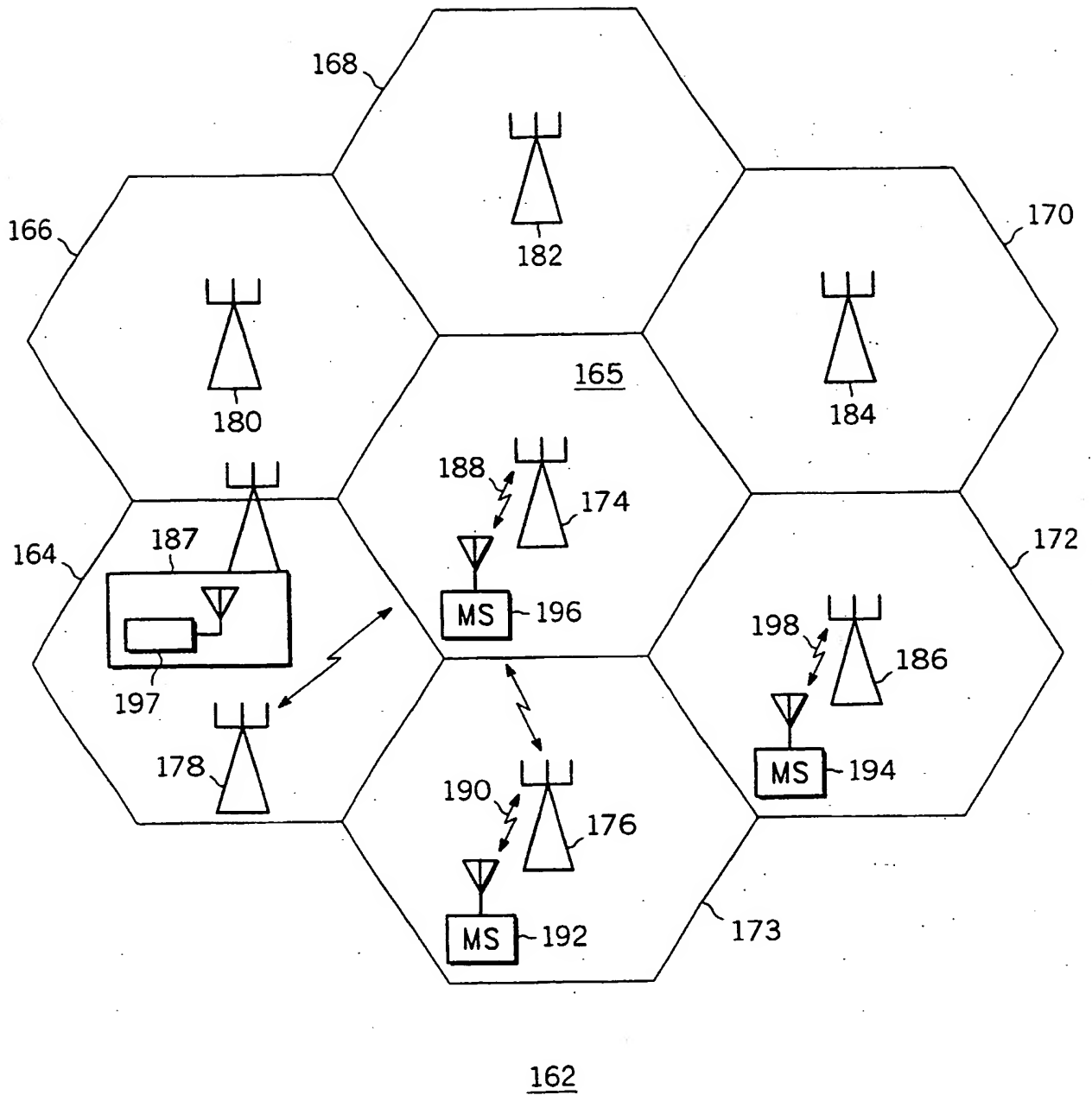


FIG. 2

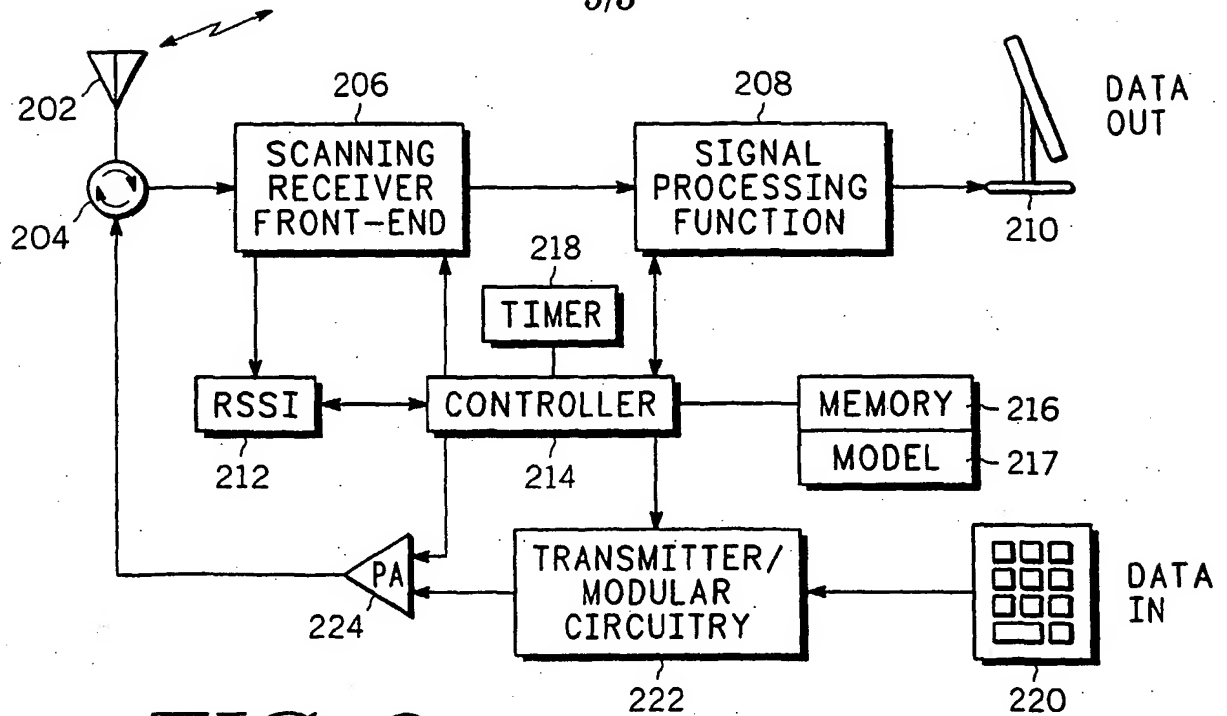
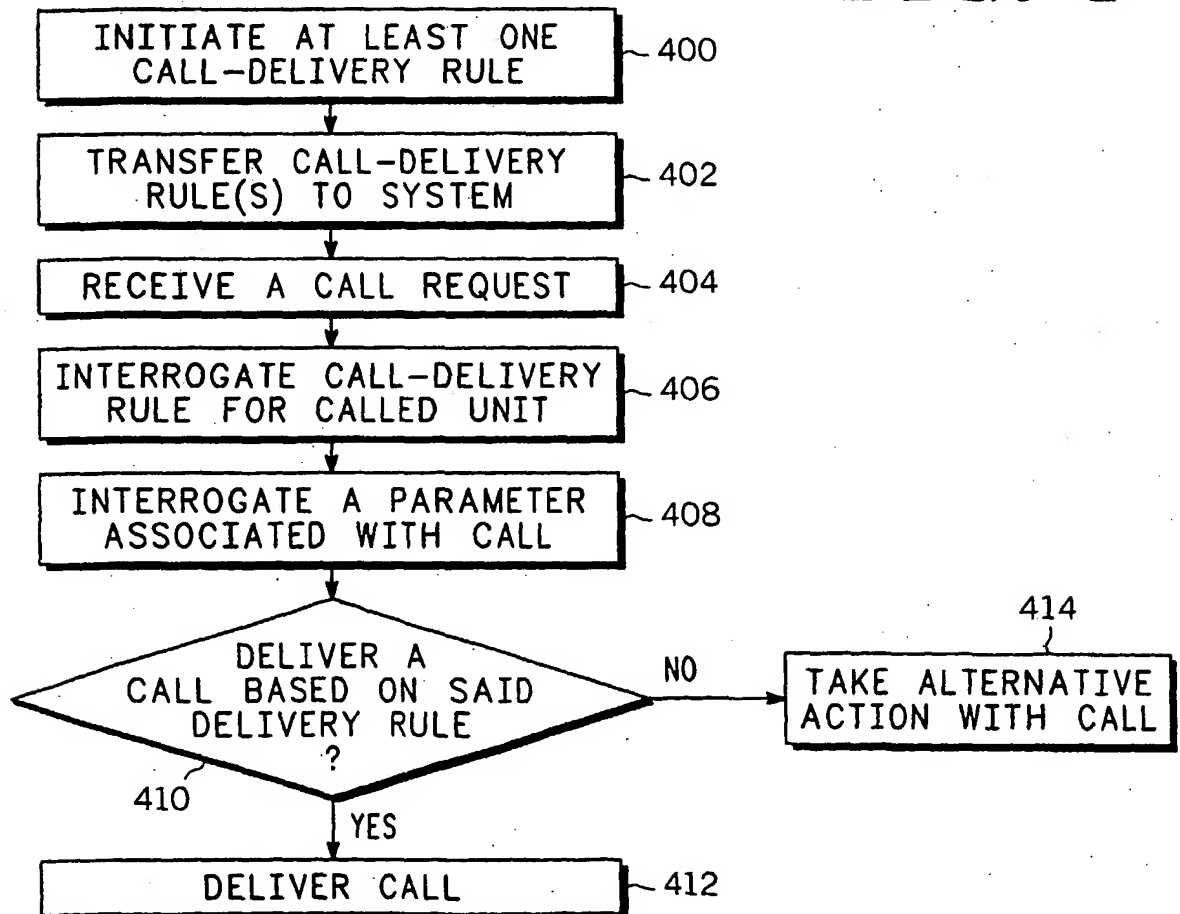


FIG. 3

FIG. 4



WIRELESS COMMUNICATION SYSTEM, COMMUNICATION UNIT AND
METHOD OF ROUTING A CALL IN A COMMUNICATION SYSTEM

5 **Field of the Invention**

This invention relates to routing of calls in a wireless communication system. The invention is applicable to, but not limited to, call screening based on subscriber
10 location in a cellular communication system.

Background of the Invention

15 Wireless communication systems, for example cellular telephony or private mobile radio communication systems, typically provide for radio telecommunication links to be arranged between a plurality of base transceiver stations (BTSS) and a plurality of subscriber units, often termed
20 mobile stations (MSS). The term mobile station generally includes both hand-portable and vehicular mounted radio units.

Wireless communication systems are distinguished over
25 fixed communication systems, such as the public switched telephone network (PSTN), principally in that mobile stations move between service providers (and/or different BTS) and in doing so encounter varying radio propagation environments.

In a wireless communication system, each BTS has associated with it a particular geographical coverage area (or cell). The coverage area is defined by a particular range where the BTS can maintain acceptable
5 communications with MSs operating within its serving cell. Often these cells combine to produce an extensive coverage area.

The communication link from the BTS to a MS is referred
10 as to the down-link. Conversely, the communications link from a MS to the BTS is referred to as the up-link.

In the field of this invention it is known that information about a subscriber's location can be used to
15 decide how to route an incoming telephone call to a subscriber user. For example, if a subscriber is in his/her normal place of work, it may be more appropriate or efficient to route an incoming call to a fixed line, whereas if (s)he is in a car it would be necessary to
20 route the call to his/her mobile phone.

Additionally, it is also known that location information can be used, for a given subscriber terminal type, to choose which communication link(s) should be used to
25 reduce call cost or delay in delivering the call to the intended recipient.

Furthermore, it is known that telephone calls, including cellular calls, can be screened by the user. The
30 incoming call request may include the number of the caller. This information is propagated through the

infrastructure to the mobile as part of the call setup unless the caller has barred the transfer of this information.

5 However, this approach has the disadvantage(s) that call screening is performed by either:

(i) the caller not wanting to let the called person know who is calling, by barring the identification of the calling person, or

10 (ii) the called person receiving the call, and thereby being interrupted from whatever activity they were involved in. The called person effectively screens the call, usually by reviewing an indication on a display, to determine whether they wish to answer the
15 call.

Clearly, there will be numerous times when the called person does not wish to be disturbed for any reason, or only for emergency calls. The current state of the art
20 means that they are disturbed each and every time, and occasionally, when the caller ID is available, can selectively screen calls, once disturbed.

25 In summary, there exists a need in the field of this invention to provide a communication system, a communication unit and a method for routing a call in a communication system wherein at least some of the aforementioned disadvantages may be alleviated.

Statement of Invention

In accordance with the present invention, there is provided a communication system, as claimed in claim 1.

5

In accordance with the present invention, there is provided a communication unit, as claimed in claim 13.

In accordance with the present invention, there is provided a method of routing calls to a communication unit, as claimed in claim 17.

10

Brief Description of the Drawings

15

Exemplary embodiments of the present invention will now be described, with reference to the accompanying drawings, in which:

20 FIG. 1 shows a block diagram of a cellular radio communications system adapted to support the various inventive concepts of a preferred embodiment of the present invention;

25 FIG. 2 shows a cell-based communications system adapted to support the various inventive concepts of a preferred embodiment of the present invention;

FIG. 3 shows a block diagram of a subscriber unit adapted to support the inventive concepts of the preferred
30 embodiments of the present invention; and

FIG. 4 shows a flowchart of a call-delivery mechanism in accordance with a preferred embodiment of the present invention.

5

Description of Preferred Embodiments

The preferred embodiment of the invention is described with reference to a TDMA, cell-based communications system such as a GSM cellular or PMR communications system, although the inventive concepts contained herein can readily be extended to other access protocols.

10 The inventive concepts of the present invention address call screening in a contrasting manner to that taught by the prior art. The present invention addresses call screening by operating at the call admission level (i.e. effectively the acceptance or not of the call by the communication system serving the subscriber).

The decision on whether to admit the call for delivery is based on at least one delivery rule, preferably defined by the user. One example on how the rule(s) can be applied is in the case where a call may or may not be routed to the intended recipient depending on subscriber location. Hence, instead of the subscriber deciding whether or not to answer a call when his/her phone rings, for example via caller line identification (CLI), the system can automatically decide not to accept the call

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for subsequent routing to the intended subscriber on the basis of, say, the subscriber's location.

One scenario where the inventive concepts of the present invention can be applied is where the subscriber is found to be at home, and the system, in following the user's delivery rule, may not admit a call originating from the subscriber's place of work or a work colleague. Clearly, the subscriber would have complete control of this operation in the sense that (s)he sets up the rule(s) governing which calls are routed to him/her, and at what times depending on, say, his/her location.

In the preferred embodiment of the invention, this would require the system to know the location of the subscriber to a reasonable level of resolution. It may also require knowledge of the identity of the caller (or the caller's phone) or his/her location or both. Time of day, day of week, a diversion number etc. may also be an input parameter to the decision process, as may a number of other parameters, as described later. With regard to the diversion number option, the recipient may wish to reject calls on time of day, week etc instead of, or in addition to location-based screening. In such a manner, diversion to a different number, for example to a voice mail number or to a colleague, means the call doesn't have to be lost.

The subscriber would be able to set up and edit these rules whenever required, probably via his/her terminal device, for example over-the-air transmission of the

call-delivery rule(s) to the communication system by the subscriber's cellular telephone.

Additionally, it may be appropriate to add further
5 sophistication to the system. For example, a call
rejected on the basis of a rule could be diverted to a
voice mail system or a work colleague. Furthermore, the
caller may be in a position to provide additional
information to the system that could override the
10 rejection in certain circumstances, for example by
defining the subject of the call or the urgency or
importance of the call. However, again, it would be the
recipient subscriber who defines the rule(s) associated
with such additional information.

15
To ease the burden on the subscriber in setting up the
rules, a number of simplifying approaches can be
envisaged. For example, for geographical area based
rules, the user could simply say that certain calls
20 should be barred depending on whether the location is
residential, business, recreational (e.g. sports centre),
or public, for example on a road between areas, 'general'
rural areas, etc). A system database could then be used
to correlate against current location to enforce the
25 rule. Known location determination technology, such as
the global positioning system (GPS) could be used to
provide such detailed location information.

Finally, it should be noted that this concept is
30 particularly powerful in communication systems where
telephone numbers are no longer associated with

particular devices but with individuals, irrespective of the device carried or used at any particular time or in any particular place.

5 FIG. 1 shows, in outline, a cellular telephone communication system 10 supporting a Global System for Mobile communication (GSM) air-interface in accordance with a preferred embodiment of the invention. The GSM air interface has been defined by the European
10 Telecommunications Standards Institute (ETSI).

Generally, the air-interface protocol is administered from base transceiver sites that are geographically spaced apart - one base site supporting a cell (or, for
15 example, sectors of a cell) as shown in FIG. 2. Similarly, co-located base transceiver sites supporting, say, both pico- and micro- cellular communications may also benefit from the inventive concepts described herein.

20 A plurality of subscriber units (12-16) communicate over the selected air-interface 18-20 with a plurality of base transceiver stations (BTS) 22-32. A limited number of MSs 12-16 and BTSS 22-32 are shown for clarity purposes
25 only. The BTSS 22-32 may be connected to a conventional public-switched telephone network (PSTN) 34 through base station controllers (BSCs) 36-40 and mobile switching centres (MSCs) 42-44.

30 Each BTS 22-32 is principally designed to serve its primary cell, with each BTS 22-32 containing one or more

transceiver units and communicating 56-66 with the rest of the cellular system infrastructure

Each Base Station Controller (BSC) 36-40 may control one
5 or more BTSs 22-32, with BSCs 36-40 generally
interconnected through MSCs 42-44. Processes within the
MSCs are provided to account for the situation where an
MS (12-16) passes between two BTS serving areas, for
example MS 12 moving from the area covered by BTS 22 to
10 the area covered by BTS 24, where the two BTSs are
controlled by different BSCs (BSCs 36 and 38 in this
example).

Similar processes are supported in MSCs to account for
15 the situation where an MS moves between serving BTSs
where these BTSs are connected to different MSCs. These
mechanisms therefore allow the cellular telephone
communication system to support handover of the MSs 12-16
between cells for most if not all cases encountered.

20 Each MSC 42-44 provides a gateway to the PSTN 34, with
MSCs 42-44 interconnected through an operations and
management centre (OMC) 46 that administers general
control of the cellular telephone communication system
25 10, as will be understood by those skilled in the art.
The various system elements, such as BSCs 36-38 and OMC
46, will include control logic 48, 50, 52, with the
various system elements usually having an associated
memory function 54 (shown only in relation to BSC 38 for
30 the sake of clarity). The memory function 54 typically

stores historically compiled operational data as well as in-call data, system information and control algorithms.

A home location register (HLR) 80 is positioned within the infrastructure and is connected with the network of MSCs, generally referred to the Network Sub System (NSS). Each MSC 42, 44 typically has a visitor location register 47, 49 associated with it, using information downloaded to it from the HLR 80, generally when MSs first attach to a BTS connected via a BSC to the respective MSC, to identify and route calls to MSs situated within its service area.

In accordance with a preferred embodiment of the present invention, the HLR 80, and VLRs 47, 49 have been adapted to include more information in their respective databases (per subscriber) to identify and track MS-related call barring/ call routing rules. The respective MSC's VLR 47, 49 copies the full record of the MSs 12-16 call barring/ call routing rule(s), from the HLR 80, when the subscriber is camped on one of its cells.

Consequently, the respective MSCs 42, 44 have also been adapted, to use the subscriber's rule(s) and any appropriate call-related information in the incoming call message.

It is within the contemplation of the invention that the delivery rules may use any aspect of a call, to enable the system/MSC to determine whether to route the call to the intended MS 12-16. Such call-related information preferably includes at least one of the following: date

and/or time of the call, caller line identification, caller location, subscriber location, diversion numbers, subject matter of the call (business, personal, general information etc.), urgency or importance of the call.

5

A more permanent set of subscriber records is held on the HLR 80. The HLR 80 is updated only when subscriber data changes, for example the subscriber's telephone number is changed.

10

It is within the contemplation of the invention that such call routing decisions may be performed at levels or positions within the infrastructure other than at the MSCs 42, 44. Such decisions, for example, could be made at the OMC 46, with an approval for continuing routing the call requested from the OMC 46 before the MSC 42, 44 routes the call. Although this is not generally within the scope of the OMC's function, it highlights the fact that the inventive concepts of the present invention can be implemented in any number of ways. Alternatively, the BSS may make the decision, if it is provided with at least one of the call barring/ call routing rules.

15

It is also within the contemplation of the invention that the call barring/ call routing rules may be distributed throughout the infrastructure, for example date and time related rules could be organized at the BSS level, whereas location or caller identification rules may be performed at say, the MSC 42, 44 level.

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In the context of the present invention, a location area management scheme locates MSs within the system. The location management scheme may incorporate such technologies as the global positioning system (GPS), to
5 pin-point the location of any particular MS 12-16.

It is within the contemplation of the invention that alternative radio communication architectures could benefit from the inventive concepts described herein.

10

Turning now to FIG. 2, a conventional cell plan 162 containing interconnected cell areas 164-173 is shown. Each cell area has a base station sub-system (BSS) 174-187 with MSs 192-197 respectively affiliated therewith,
15 shown via communication links 188, 190.

Generally, as will be understood by persons skilled in the art, a MS is in communication with its nearest BTS (which together with the BSC forms the BSS); one example
20 of this relationship is shown in relation to BSS 174 and mobile station 196 of cell 165.

MS 197 is shown having chosen cell 164 as the cell it currently wants to be associated with, namely the cell
25 that the MS has 'camped on'. This cell selection is usually based on signal strength and/or signal quality indications determined by monitoring broadcast channel transmissions sent from the BSS of each cell, in this case BSS 178.

30

Once camped on cell 164, MS 197 will transmit a location update message to the BSS 178 of that particular cell 164. The BSS 178 of the cell 164 reports this location information back into the network to its attached MSC.

5

The MSC is usually associated with a VLR database, as shown in FIG. 1. This VLR database is a set of temporary records holding information on the MSs camped onto cells under its jurisdiction. When MS 197 camps onto cell 164, the associated MSC/VLR copies the data record for MS 197 into its respective VLR, to enable call to be routed successfully to MS 197. The VLR also holds the paging group (group of cells) which cells are typically paged to determine the current cell location of the MS 12-16. It is within the contemplation of the invention that the call delivery rule(s) for a particular MS may also be transferred during this process.

In operation, MS 197 has initiated a delivery rule set up with the MSC (not shown) supporting the cell coverage area 162. MS 196 has initiated a call to MS 197. The call-delivery rule(s) may cause the call to be rejected, based on, for example:

- (i) a caller identification (ID) of the MS 196 (for example if it is a work colleague), or
- (ii) MS 197's location, shown here as being in a church 199, or
- (iii) with regard to the time/day, for example if it is a Sunday.

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It is clearly within the contemplation of the invention that the call request could emanate from a fixed phone line. The MSC associated with cell 164 interrogates the VLR to determine the paging group, and any associated
5 delivery rule.

An alternative example of a rule would be when the subscriber is with a client/customer calls from the office are routed through, whereas calls from friends or
10 other (perhaps competing) client/customers are not.

Alternatively, if there is no rule that is relevant to the present call request, the MSC may send a paging message to each cell in the paging group. The MS 197
15 would receive the page message from the cell it is camped on, to which it may reply in the standard manner and completion of the call set up then carried out.

Turning now to FIG. 3, there is shown a block diagram of a MS 200 adapted to support the inventive concepts of the preferred embodiments of the present invention. The MS
20 200 contains an antenna 202 preferably coupled to a duplex filter or circulator 204 that provides isolation between receive and transmit chains within the MS 200.

25

The receiver chain, as known in the art, includes scanning receiver front-end circuitry 206 (effectively providing reception, filtering and intermediate or base-band frequency conversion). The scanning front-end
30 circuit is serially coupled to a signal processing function 208.

An output from the signal processing function is provided to a suitable output device 210, such as a screen or flat panel display.

5

The receiver chain also includes received signal strength indicator (RSSI) circuitry 212, which in turn is coupled to a controller 214 for maintaining overall subscriber unit control. The controller 214 is also coupled to the scanning receiver front-end circuitry 206 and the signal processing function 208 (generally realised by a DSP).

10

The controller 214 may therefore receive bit error rate (BER) or frame error rate (FER) data from recovered information. The controller is also coupled to a memory device 216 that stores operating regimes, such as decoding/encoding functions and the like, and data relating to a monitored list of suitable neighbouring cell sites. A timer 218 is typically coupled to the controller 214 to control the timing of operations (transmission or reception of time-dependent signals) within the MS 200, particularly in TDMA units.

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As regards the transmit chain, this essentially includes an input device 220, such as a keypad, coupled in series through transmitter/modulation circuitry 222 and a power amplifier 224 to the antenna 202. The transmitter/modulation circuitry 222 and the power amplifier 224 are operationally responsive to the controller.

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Of course, the various components within the MS 200 can be realised in discrete or integrated component form, with an ultimate structure therefore being merely an arbitrary selection.

5

In accordance with the preferred embodiment of the invention, the signal processing function 208, memory device 216, input device 220 and display unit have been adapted to receive, store and transmit to the
10 infrastructure, call-delivery rule(s) associated with the MS 200.

It is within the contemplation of the invention that the MS user is able to select pre-defined topics such as
15 location, time, day, caller identification, etc. and incorporate their particular rule requirements based on these pre-defined topics. Furthermore, the user may decide to incorporate a subject matter category for classifying incoming calls, such as business calls,
20 personal calls and/or general information calls.

All call-delivery rule(s) entered on the MS 200 via input device 220 are preferably stored in memory device 216, and are therefore available for modification at a later
25 date by displaying on the display screen. The user of MS 200 can select when to transmit the rules to its serving BTS.

Turning now to FIG. 4, a flowchart of a call-delivery
30 mechanism in accordance with a preferred embodiment of the present invention is shown. The flowchart includes

the steps of a communication unit 197, 200 initiating at least one call-delivery rule, as shown in step 400. The rule(s) is/are then transferred via a MSC 42, 44 from the communication unit 197, 200 to the HLR 80 within the
5 communication system, as shown in step 402.

When the MSC 42,44 receives a call request to set up a communication with the communication unit 197, 200, as in step 404, the MSC 42, 44 interrogates a parameter
10 associated with the call request, such as caller ID, dat/time of call, etc. as shown in step 408. The MSC also interrogates each of the communication unit's 197, 200 call-delivery rule(s), as in step 406, to determine whether to deliver a call to said communication unit 197,
15 200, based on said delivery rule(s), as shown in step 410.

If there is no rule affected by the call, or the rule permits the call to proceed, the call is delivered, as
20 shown in step 412. If the rule dictates that the call should not be delivered to the communication unit, an alternative mechanism is applied, such as re-directing the call to an answer phone, or providing an "out-of-range" or "unable to connect" return voice message, etc.

25

It is within the contemplation of the invention that processing of the delivery rules can be implemented in software, firmware or hardware, with the function being implemented in a software processor (or indeed a digital
30 signal processor (DSP)) merely a preferred option.

It is also within the contemplation of the invention that said rules may incorporate alternative delivery mechanism, for particular calls. One example would be for the communication system to recognise, from at least one call-delivery rule, that a call originated from the user's work place. In response to such a determination, the system would route the call to say, a home-based answer phone.

10 It is within the contemplation of the invention that the MS could have some or all of its rules built in. This would help reduce air interface activity, and may simplify and localise the procedure. Alternatively, it may be deemed that in any particular instance that there is more advantage to having fixed network, for example a PSTN, or an IP nodes, performing some or all of the rules. The advantage of performing some or all of the rules in further up in the infrastructure, by catching the rule based barring nearer to a fixed terminal, reduces the network resource involved in the to-be-barred call.

It will be understood that the aforementioned communication system, communication unit and method for routing a call in a communication system, in particular call screening based on subscriber location, provide at least the following advantages:

(i) significantly improved customer satisfaction with the service double glazing sales people and calls from work when, say, on the golf-course;

(ii) the subscriber no longer needs to interact personally with the system to screen calls at the point of ringing as many unwanted calls are barred before
5 ringing occurs; and

(iii) better use of the radio frequency, or network, resource and the communication link between the MSCs, BSCs and BTSs, such that only calls that the MS user
10 wants to receive, are ultimately transmitted over the air.

Thus a communication system, a communication unit and method of call routing has been provided, particularly
15 with respect to call screening based on subscriber location, wherein at least some of the aforementioned disadvantages of the prior art have been alleviated.

Claims

1. A communication system having a receiver for receiving a call for routing to a communication unit operable within the communication system, the receiver operably coupled to a processor and call determination means, the communication system characterised by the call determination means determining at least one parameter associated with the call and said processor employing a rule based call delivery function to determine whether to route said call to said communication unit based on said determined parameter.
2. A communication system according to claim 1, wherein the communication unit includes processing means for a communication unit user to generate at least one call-delivery rule and a transmitter to transmit said at least one call-delivery rule to said communication system.
3. A communication system according to claim 1 or claim 2, wherein the call delivery rule includes an alternative delivery route and the communication system includes means to divert calls to such an alternative delivery route if required by the rule.

4. A communication system according to any one of the preceding claims, wherein said processor and said call determination means are provided within a mobile
5 switching centre.

5. A communication system according to any one of preceding claims 1 to 3, wherein said call determination means are distributed within an infrastructure of said
10 communication system.

6. A communication system according to any one of the preceding claims, wherein said at least one parameter of the call includes at least one of the following: date of
15 the call, time of the call, caller line identification, caller location, a diversion number, subject matter of the call, urgency or importance of the call.

7. The communication system according to any one of
20 the preceding claims, wherein said parameter is a location of the communication unit, the communication system further characterised by location determination means to determine said location of the communication unit, and said call determination means determining
25 whether to route said call to said communication unit or screen said call based on a location of said communication unit.

8. The communication system according to claim 7, said communication system further characterised by location storage means operably coupled to said location determination means for storing information relating to a
5 current location of said communication unit.

9. The communication system according to claim 7 or claim 8, said communication system further characterised by said location determination means being operably
10 coupled to a database for correlating said location of said communication unit with a type of geographical area and said call determination means determining whether to route said call to said communication unit or screen said call based on said type of geographical area location of
15 said communication unit.

10. The communication system according to claim 9, further characterised by said type of geographical area including at least one of the following: residential,
20 business, recreational, public.

11. The communication system according to any one of the preceding claims, the communication system further characterised by caller determination means to determine
25 an identity of a calling communication unit, and said call determination means determining whether to route said call to said communication unit or screen said call based on said identity of said calling communication unit.

12. The communication system according to any one of the preceding claims, the communication system further characterised by second location determination means to determine a location of a calling communication unit, and
5 said call determination means determining whether to route said call to said communication unit or screen said call based on a location of said calling communication unit.

13. A communication unit comprising a transmitter operably coupled to a signal processing function, in turn operably coupled to an input device, the communication unit characterised in that the input device is adapted to
5 receive a call-delivery rule entered by a user of said communication unit, said processor is adapted to recognise and process said call-delivery rule and said transmitter transmits said call-delivery rule to a communication system serving said communication unit to
10 implement said call-delivery rule with calls addressed to said communication unit.

14. The communication unit according to claim 13, the communication unit further characterised by a memory
15 device 216 adapted to store said call-delivery rule, for later modification.

15. The communication unit according to claim 14, the communication unit further characterised by a display
20 unit operably coupled to said memory device to display at least one stored call-delivery rule to said user.

16. The communication unit according to any one of claim 13 to 15, the communication unit further
25 characterised by said call-delivery rule includes at least one of the following: date of the call, time of the call, caller line identification, caller location, a diversion number, subject matter of the call, urgency or importance of the call.

17. A method of routing a call to a communication unit in a communication system, the method characterised by the steps of:

- 5 receiving a call request to communicate with said communication unit;
- interrogating at least one parameter associated with said call request;
- interrogating a call-delivery rule associated with said communication unit;
- 10 determining whether to deliver a call to said communication unit, based on said delivery rule and said at least one parameter; and
- delivering said call to said communication unit in response to a positive determination.

15

18. The method of routing a call to a communication unit according to claim 17, the method further characterised by the steps of:

- initiating, by said communication unit, at least one
- 20 call-delivery rule; and
- transferring said at least one call-delivery rule from said communication unit to said communication system.

19. The method of routing a call to a communication unit according to claim 17 or claim 18, the method further characterised by the steps of:

camping on, by said communication unit, a
5 communication cell where calls are facilitated by a serving communication unit;

transmitting, by said communication unit, a location update message to said serving communication unit to indicate to said communication system a location
10 of said communication unit; and

registering said location of said communication unit in said communication system to facilitate subsequent delivery of calls to said communication unit via said serving communication unit if said call-delivery rule
15 provides a positive determination.

20. The method of routing a call to a communication unit according to any one of claims 13 to 15, the method further characterised by the step of re-directing said
20 call if said call-delivery rule proposes re-direction for said determined at least one parameter.

21. A communication system substantially as hereinbefore described with reference to, and/or as illustrated by, FIG. 1 or FIG. 2 of the accompanying drawings.

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22. A communication unit substantially as hereinbefore described with reference to, and/or as illustrated by, FIG. 3 of the accompanying drawings.

10 23. A method of routing a call in a communication system substantially as hereinbefore described with reference to, and/or as illustrated by, FIG. 4 of the accompanying drawings.

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INVESTOR IN PEOPLE

Application No: GB 0028528.8
Claims searched: 1-12 and 17-19

Examiner: Hannah Sylvester
Date of search: 22 July 2001

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): H4L (LRCMR, LRPLS, LDPB, LESF, LEUF), H4K (KF54)

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Other: Online: WPI EPODOC JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB2324224A (MITEL) see whole document	1-6, 11, 17 and 18
X	EP0510411A2 (ROLM) see whole document	1-6, 11, 17 and 18
X	US5930700A (BELL) see whole document	1-11, 17 and 18
X	US5841848A (LUCENT) see whole document	1-6, 17 and 18

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.